How Strong Is Your Tinder Game? Two-Sided Search in Swipe-Based Dating Apps

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Abstract

In today's love market, swipe-based dating apps have a well-established presence, but novel platform features such as directed search algorithms and swiping caps add significant complexities to the user's search problem that have not been studied in existing literature. This paper formulates a game-theoretic model of two-sided search within swipe-based dating apps and, using numerical computation methods, approximates the steady-state equilibrium. The effects of various model parameters are assesed using comparative statics and used to replicate and explain stylized facts observed in aggregate Tinder data. Finally, agent-based simulations are used to analyse off-path dynamics and discuss how exogenous platform features (such as the matching algorithm and the swiping caps) can be set in a socially-efficient manner. By analysing the effects of platform design and its implied constraints on user behaviour, this research aids dating platforms in improving social efficiency and provides a first step towards pricing models for subscription plans to these platforms.

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2019-2022

Contents

1 Introduction

Points to discuss on introduction

- What is Tinder? (brief)
  - When was it started?
  - What is swiping?
  - How popular it is?
- Why does Tinder pose an interesting economic problem?
  - Stage interaction
  - Platform features: budgets, observability, directed search, asynchronicity
  - Repeated games: curse of dimensionality, beliefs and meta-beliefs
- What and how does this paper study?
  - Model of two-sided search with strategic considerations
  - Equilibrium refinement, computation, and analysis
  - Planner considerations on directed search and budget setting
- What does this paper contribute?
  - First model to address budgeted search in Tinder?
  - First model to combine idiosyncracy and pizzaz
  - Case study for the use of computational techniques in

1.1 Related Work

- Searching and Matching
  - Gale and Shapley (1962), Roth and Sotomayor (1992)
  - Two-sided: Burdett and Wright (1998), Chade (2006), Smith, Adachi
  - **Does not consider budgets**
    - ... important as this is a way for planners to influence outcomes
- Mean-Field Game Theory: Iyer et al. (2014), Gummadi et al. (2013), Jovanovic and Rosenthal (1988)
  - No models on MFG for Tinder
- Modern Dating Apps: Olmeda (2021), Kanoria and Saban (2021)
  - Not models where behaviour is derived from rational utility-maximizing assumptions

2 Theoretical Model

2.1 Setup

- Who are the players?
  - Disjoint sets of men and women in the platform
  - They have attractiveness type $\mu, \omega \in [0, 1]$
  - They do not know (or care) about their own attractiveness.
- What do they do?
  - They get anonymously and sequentially partnered up.
  - To their knowledge, this happens in a random manner.
  - They observe the suggestion's attractiveness
  - They can choose to swipe left or right, thus $\mathcal{A} = \{0, 1\}$.
  - If they both swipe right on each other, they match. Note this doesn't mean they leave.
- What do they know?
  - Equally agents face a cap on the number of right swipes they have
  - B_m for men and
- What are their preferences?
  - Players get no payoffs from not matching, and $u(\mu)$ or $u(\omega)$, where $u(\cdot)$ is increasing, concave, and crosses through the origin.
  - This is evident since users can unmatch with each other, making all matches weakly preffered to non-matching.

2.2 The Dating Market

- Entry flows
- Leaves (including geometric lifetime)
- Masses
- Distribution
- Steady State

2.3 The Search Problem

- Present case for women, then say case for men follows
- Condition on male strategy and steady state
- Present Ex-interim utility maximization
  - Show it reduces to a constant
- Present sequence problem
- Derive Bellman equation
- Prove uniqueness of value function and solution
- Derive solution

3 Equilibrium

3.1 Steady-State Equilibrium

- Define and explain concept of SSE
- Explain computation via least-squares
- Explain main properties (eg. ESS & uniqueness)

3.2 Comparative Statics

- Present CS on individual factors and explain intuitively
- These include: patience, risk aversion, distributions
- Present case of gender disbalance... why is it that men always swipe right?
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4 Agent-Based Simulations

4.1 Convergence and Dynamics

- Check Mass convergence
- Check distribution convergence
- Relate to ESS
- What about Dynamics??? BR

4.2 Directed Search

- try page rank
- try elo rating
- try v simple RW algo
- Do any of these converge onto GS (note... define gale shapley mathcings)?

4.3 Social Efficiency

5 Conclusion

In this chapter we shall do a reference to an entry in the bibliography, `bibliography.bib`.

What we know of the invention of the flux capacitor is that Dr. Emmett Brown thought of this when hanging a clock in the bathroom. He was standing on his porcelain sink and slipped because it was wet, the resulting hit on the head was apparently a cause to this invention Brown (1955).

5.1 Future Work

The corresponding sketch made on this day has been attached in appendix B.

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A Uniqueness and Existence of Search Problem

B Notation

- Male types μ
- Female types ω
- Strategies $s = (s_m, s_w)$
- CDF's $M(\mu, b)$, $W(\omega, b)$
- Densities $m(\mu, b)$, $w(\omega, b)$
- Discount δ
- Population CDF's F_m, F_w
- Masses N_m, N_w
- Entry Flows λ_m, λ_w
- Tightness $\tau = \min\{\frac{N_w}{N_m}, 1\}$
- Effective discount α